



Assessment of Regulatory Quantification and Reporting Requirements for Air Emissions from Industrial Facilities

–Executive Summary–

Submitted to:

Canadian Council of Ministers of the Environment

Submitted by:

Marbek Resource Consultants Ltd.

November 12th, 2008

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EXECUTIVE SUMMARY

This report has been prepared for the Canadian Council of Ministers of the Environment (CCME) to characterize and assess the quantification and reporting requirements for air emissions from industrial facilities in jurisdictions across Canada as well as leading international jurisdictions.

Background and Objectives

The Federal Government's proposed Regulatory Framework for Industrial Air Emissions is expected to set fixed emission caps for a variety of air pollutants, including nitrogen oxides (NO_x), sulphur oxides (SO_x), volatile organic compounds (VOCs), and particulate matter (PM). The Federal Government has also indicated its intention to work to reach equivalency agreements with those provinces that have provincial emissions standards that are at least as stringent as the federal standards. Quantification and reporting requirements will necessarily be an important aspect of the development of those equivalency agreements and the overall Federal approach.

The specific objectives of this study are to:

- Compile the approaches to regulatory emission quantification and reporting requirements across Canada and in leading international jurisdictions
- Compare and contrast the approaches in order to identify best practices; and,
- Recommend elements that could form the basis for a national approach that would support the implementation of the Federal Framework for Industrial Air Emissions.

Regulatory Context

Canadian authority over air quality is divided between the federal and provincial governments, with territories, regional districts and municipalities also exercising delegated authority. Each jurisdiction employs a variety of laws and regulations to control emissions from industrial facilities, generally encompassing emission limits, permitting requirements, and quantification and reporting requirements. Quantification and reporting is important in confirming compliance and in assessing air quality impacts. Until now, the permitting of air emissions from industrial facilities has been left to the provinces and municipalities, with limited federal involvement, other than the establishment of ambient air standards. The Canada-Wide Standard (CWS) on PM and ozone mandates the provinces to develop implementation plans, including plans to control emissions from industrial facilities, and report on progress, but there is no formal oversight.

Internationally, the process for issuing permits and ensuring compliance is generally implemented at a sub-national level. Often, a national or even a supra-national body (e.g. the European Union) will establish standards (e.g. ambient air quality standards) or, less

frequently, detailed rules regarding the assignment of emission limits, but the actual permitting is done by states, provinces, *länders*, *departments*, counties, regions, municipalities, etc. Depending on the constitutional context (i.e. federation or unitary state), senior jurisdictions may have oversight authority. Oversight by senior jurisdictions is usually the case when permitting is delegated to counties or municipalities. In the US and EU countries, there is some level of national oversight. In Australia, the permitting of air emissions from industrial facilities has been left to the States, with limited national direction/guidance other than the establishment of ambient air standards.

Overview of Approaches

Industrial sectors and facilities across the country have substantially different quantification and reporting requirements for air pollutants. The major reason for this variation is that jurisdictions develop quantification approaches that are suited to the individual characteristics and location of their facilities. In addition, jurisdictions have also tailored their overall approach to emission quantification and reporting to match their process for compliance.

Most jurisdictions rely heavily on a case by case analysis to set both emission limits and quantification and reporting requirements. This reflects the important variations in conditions that may apply (e.g. different industrial process, different fuels, airshed characteristics, etc.). Although this allows jurisdictions flexibility to account for varying conditions, it creates inconsistencies and inefficiencies.

In response some jurisdictions have attempted to develop overall or sectoral standards or guidelines, specifying, for example the situations that require continuous emissions monitoring and the requirements associated with manual source performance tests. However, the scope for variations is greater in some sectors than in others and the opportunity to standardize is similarly variable. Thus the degree of standardization varies, both by sector and by jurisdiction.

Outside of Canada, national bodies have, in some instances, taken on the standardization mandate. In many cases, they have established overall standards for quantification and reporting (e.g. quantification sufficient to establish compliance; quantification sufficient to yield representative data; use of methods, instruments, etc. consistent with the regulated standard; reporting every two years). Occasionally, national bodies also specify specific requirements (e.g. by sector, by substance, by type of emissions source).

Section 4 of the Report describes typical approaches in Canadian jurisdictions, and identifies the principal variations and exceptions. Section 5 compares these typical approaches with those of U.S., European and Australian jurisdictions.

Quantification

Jurisdictions usually prescribe specific approaches in permits and approvals and specific quantification methods in guidelines. However, jurisdictions often allow for deviations that allow quantification approaches that are comparable or provide improved accuracy. Where standard quantification approaches are defined, it is usually on the basis of the specific emission source (i.e. unit process or operation) and by pollutant. In a few instances, the requirements/guidelines are specified or organized by industry sector but in most jurisdictions this is not the case.

Some requirements are fairly common even in the absence of standards. This extends across facilities within sectors, across sectors and even across jurisdictions. Some jurisdictions have taken advantage of this consistency to develop explicit requirements or guidelines but many (including Canadian jurisdictions) have not. Exhibit E.1 summarizes the most common quantification methodologies that have been identified for pollutants of concern for each of the industrial sectors based on the Canadian and international jurisdictional review. The quantification methodologies are broadly organized into five categories including, Continuous Emissions Monitoring Systems (CEMS'), manual stack testing, Parametric Emissions Monitoring System (PEMS'), Mass Balance or Emission Factors.

Exhibit E.1: Summary of Quantification Methodologies for Major Sources of Industrial Pollutants of Concern by Sector

Sector	NO _x	SO _x	PM	VOC	Other Pollutants
Aluminum		Manual Stack Testing	Manual Stack Testing and COMS		Fluorides: (Manual Stack Testing, CEMS for dry scrubber stacks)
Base Metal Smelting		CEMS	CEMS		Mercury (Manual Stack Testing)
Cement	CEMS	CEMS	Manual Stack Testing and COMS CEMS		
Chemicals Manufacturing	Manual Stack Testing	Manual Stack Testing CEMS for sulphuric acid plants	Manual Stack Testing	Emission Factors Manual Stack Testing	NH ₃ : (Manual Stack Testing) Fluoride: (Manual Stack Testing)

Sector	NO_x	SO_x	PM	VOC	Other Pollutants
Electricity	CEMS	Manual Stack Testing Mass Balance for Natural Gas CEMS for coal fired	Manual Stack Testing and COMS CEMS		Mercury: (Manual Stack Testing, CEMS)
Iron, Steel & Ilmenite Smelting	Manual Stack Testing CEMS	Manual Stack Testing CEMS	Manual Stack Testing CEMS	Emission Factors	
Iron Ore Pellets	Manual Stack Testing	Manual Stack Testing	Manual Stack Testing		
Lime	Manual Stack Testing	Manual Stack Testing	Manual Stack Testing		
Natural Gas Transmission, Distribution & Storage	Emission Factors PEMS		Emission Factors	Emission Factors (LDAR)	
Oil Sands	CEMS	CEMS	Manual Stack Test with COMS	Emission Factors (LDAR)	H ₂ S: (Mass Balance) TRS: (CEMS)
Petroleum Product Terminals				Emission Factors (LDAR) Manual Source Testing	
Petroleum Refining	CEMS	CEMS	Manual Stack Test with COMS	Emission Factors (LDAR) Manual Source Testing	Benzene: (Emission Factors) H ₂ S: (Mass Balance)
Potash			Manual Stack Test		
Pulp & Paper	Manual Stack Testing CEMS for Kraft Mills	Manual Stack Testing CEMS for Kraft Mills	Manual Stack Testing with COMS		TRS: (CEMS)

Sector	NO_x	SO_x	PM	VOC	Other Pollutants
Upstream Oil & Gas		Manual Stack Testing PEMS CEMS for sulphur recovery plants		Emission Factors (LDAR)	H ₂ S: (Mass Balance) Benzene: (Emission Factors)
Wood Products	Manual Stack Testing		Manual Stack Testing	Manual Stack Testing	

Reporting

Variation in reporting requirements generally mirrors that of quantification requirements. Most provinces require an annual summary report, including an analysis that demonstrates that both source emission limits and ambient limits are being met and describes the quantification methodologies used for individual sources. If emission or ambient limits are not being met, then the facility must report on the remedial measures that would bring the facility within the allowable limits. Additional detail in these reports typically includes information on process changes that have been made and abnormal operating conditions and how these conditions may have impacted total releases of air pollutants.

Given the differences in reporting approaches, the information that would likely be required for the proposed Federal Framework for Industrial Air Emissions may not be currently available. As noted above, some jurisdictions are not currently collecting consistent and comparable data on total facility wide emissions of air pollutants for regulatory compliance. Information on facility wide emissions will be crucial for the proposed Federal Framework and the development of a potential cap and trade system. The format of annual summary reports and emission monitoring reports also varies considerably; some jurisdictions have standardized reporting formats available, while other jurisdictions receive reports that have not been standardized and vary for almost every individual facility. In addition many jurisdictions such as Nova Scotia and British Columbia still rely on the submission of paper reports only and do not require electronic copies that can be easily disseminated.

In almost all cases, information concerning permits is public. This usually includes information on quantification and reporting requirements as well as the actual performance standards. In some cases, however, the information is not easily accessible. This may be because it can only be obtained through access to information requests, or because the requirements are contained in a variety of source-permits issued over time, rather than facility-wide permits that are renewed regularly. Facility reports are not as easily obtained in Canada and it may be that there are concerns related to the confidentiality of the data provided by facilities.

In both the U.S. and the E.U., permits and reports are meant to be public; however in many cases access (particularly to reports) remains difficult.

Potential Best Practices

The information collected from Canadian and international jurisdictions reveals some common approaches and practices, as well as some interesting differences and contrasts. However, no objective evidence was found to indicate that any jurisdiction's practices are better at reducing emissions and/or ensuring compliance, or more efficient in doing so. In particular, the research did not reveal any program evaluations that would have allowed conclusions about effectiveness, efficiency or lessons learned, nor did jurisdictions highlight any significant findings or lessons learned about effectiveness.

Nevertheless, the Project Team has identified a list of candidate "best practices". These were selected on the basis of our observation of an apparent consensus of jurisdictions and our judgment of what would be most likely to contribute to effectiveness, cost-effectiveness, consistency, accessibility, transparency and simplicity. The list is presented in Exhibit E.2. Advantages and disadvantages of these practices are assessed in the Report.

Exhibit E.2: Candidate Best Practices

Category	Candidate Best Practices
Quantification of Emissions	<ul style="list-style-type: none"> • CEMS of major sources including those that may operate infrequently but that can lead to major emissions • Use of standardized US EPA quantification methods • Assigning specific quantification methods based on facility production thresholds • Differentiated quantification requirements based on the type of fuels burned or process • Minimum annual quantification of emissions • Development of quantification Codes of Practice for specific emission sources • Use of Predictive Emission Monitoring (PEMS)
Coverage of Pollutants	<ul style="list-style-type: none"> • Quantification and reporting for all criteria air contaminants emissions • Quantification and reporting of other significant toxic air pollutants
Auditing and Verification	<ul style="list-style-type: none"> • Third party verification of emissions monitoring and reporting • Annual certification of compliance issued by facility
Reporting	<ul style="list-style-type: none"> • Requirement of Annual Emission Summary Reports • Reporting of performance of air pollution control equipment • Reporting of CEMS monitoring results in real time • Requirement to maintain Quantification and Reporting Records
Public Access	<ul style="list-style-type: none"> • Publication of environmental permits, monitoring data and emission summary reports on-line

Conclusions and Recommendations

Our main conclusions and recommendations are as follows:

- **Regulatory Framework**

<p><i>Conclusions</i></p> <ul style="list-style-type: none"> • Canadian provinces, territories and relevant regional districts and municipalities have well-established programs for specifying regulatory quantification and reporting requirements. • A separate Federal program for quantification and reporting would be duplicative and therefore not cost-effective.

- In all the international jurisdictions examined, the implementation of quantification and reporting is left to sub-national entities.

Recommendation

- The Federal Government should avoid establishing a parallel system for regulatory quantification and reporting of air emissions and should rely on the provinces, territories, regional districts, and municipalities (except in the Northwest Territories).

• **Overall Approach to Quantification and Reporting**

Conclusions

- There are a wide range of different approaches to regulatory quantification and reporting of air emissions from industrial facilities in Canada. Specific requirements vary between substances, sources, sectors and jurisdictions. They also may vary between facilities in the same jurisdiction.
- Many jurisdictions have adopted a risk based approach to managing air emissions. This means that quantification and reporting requirements may vary based on factors such as the ambient level of air pollution in the area surrounding the facility, distance to sensitive receptors and dispersion characteristics of the facility emission sources. Attempts, to create a one-size fits all approach to quantification and reporting for any given sector may not be appropriate or cost effective since requirements would no longer hinge upon potential risks to the environment.
- The variety is a reflection of the different circumstances/risks associated with each permit but it also reflects a lack of standardization and a lack of easily accessible guidance on best practices.
- In most of the international jurisdictions examined, attempts have been made to provide standards and guidance to assist competent authorities in setting the quantification and reporting requirements for permits.
- In the U.S., standard rules attempt to cover all scenarios and leave little discretion. The result appears to be overly complex and inflexible. In European countries, some standards are established but there is still significant scope to adjust requirements based on circumstances.
- Many of the most common and relevant practices used in Canadian and International jurisdictions to quantify and report industrial emissions are

potential best practices – see Exhibit E.2. Their advantages and disadvantages are reviewed the Report.

Recommendation

- The Federal Government and the provinces should work together to develop a national framework for quantification and reporting. This framework would include:
 - A generic standard establishing consistent objectives, philosophy, approach, process, and hierarchy of methods for quantification and reporting. This standard should establish the principle that, at a minimum, facility-wide emissions data should be collected and reported annually.
 - A series of specific quantification and reporting standards for selected air contaminants and/or industrial sectors, where these are feasible. For example, it may be possible to standardize the requirement for continuous NO_x emissions monitoring using thresholds, geographical location, etc. Similarly, it may be possible to standardize the approach to quantification and reporting of a range of contaminants in the electricity generation sector, using thresholds, fuel type, etc. (this could be patterned on the EU Large Combustion Facility Directive).
 - A series of guidelines for sectors where standardization is not feasible due to the variety of circumstances but where the most likely appropriate quantification approaches can be described. For example, in the chemical sector, where the range of facilities, processes and sources is too broad for standardization to be feasible, it may be possible to identify options and typical practices applicable to common unit processes and operations. In contrast with the U.S. approach, guidelines would not be prescriptive and would not attempt to cover all scenarios in detail. Instead they would identify the most common approaches along with appropriate selection considerations. It is worth noting that the Canadian Chemical Producers Association (CCPA) has developed an emissions quantification guideline for its members, which is similar to that of the Canadian Petroleum Products Institute. The CCPA document provides guidance for specific chemical subsectors (based on the chemical product produced), as well as emission sources that are common to the entire industry, such as combustion sources and fugitive leaks.
- Adoption of the practices listed in Exhibit E.2 where analysis indicates that

the advantages outweigh the disadvantages.

- **Emissions Coverage**

Conclusions

- Overall, there is relative consistency between jurisdictions in the emissions to be quantified and reported within each sector.
- Within sectors, there is variability in emissions coverage due to differences in processes or fuels.

Recommendation

- The Federal Government and the provinces should work together to capture a standard list of emissions requiring quantification for each sector. In many sectors this should be straightforward. In other sectors, this will be more difficult but it should be possible to develop a list of potential contaminants and a checklist of standard considerations in choosing which to include.

- **Quantification**

Conclusions

- Although quantification approaches are not consistent in many sectors, there are examples of de-facto standards that are emerging. These are highlighted in Exhibit E.1.
- Regarding methods and instrumentation approaches, there are well established standards and guidelines.

Recommendation

- In developing the national framework, governments should make maximum use of emerging de-facto standards and existing well-established methods and instrumentation approaches.

- **Reporting**

Conclusions

- Reporting requirements, formats and frequencies vary significantly between sectors and jurisdictions.
- Some form of annual summary report is common but not universal.

Recommendation

- The national framework should seek to standardize emission quantification approaches for large industrial emission sources.
- The national framework should seek to standardize the form of reporting and the need for an annual summary report. However, efforts to standardize reporting should recognize the unique information demands and regulatory challenges and requirements of each jurisdiction.

- **Auditing and Verification**

Conclusions

- The approach to auditing and verification varies considerably between jurisdictions. As a result, the reliability of the data reported is also variable.
- A promising approach used in Europe is to rely on independent third-party assessment organizations to prepare/certify the annual emissions summary report.

Recommendation

- The national framework should seek to harmonize the approach to auditing and verification.
- Governments should consider the possibility of using independent assessment organizations to certify the annual emissions report.

- **Data Sharing and Availability**

Conclusions

- With a few exceptions, permit requirements for quantification and reporting are publicly available but often difficult to obtain. Emission summaries and monitoring reports are even more difficult to obtain.
- There is currently no systematic sharing of facility level compliance information between jurisdictions. Ad hoc attempts to gather and share information have been time consuming and not entirely successful

Recommendation

- The national framework should work to establish common standards for public access that account for confidentiality provisions.
- The national framework should establish a process for sharing annual reports collected by provincial, territorial, regional, and municipal authorities with the federal government.
- Where documents and information are public, governments should facilitate public disclosure by posting the information on the web.